# FLOW CONTROL APPARATUS FOR FLUSH VALVES OF TOILETS

## BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to a flow control apparatus for flush valves of toilets and particularly to a flow control apparatus that changes the diameter of the valve according to variations of intake water pressure to control water flow so that water outflow quantity and time do not fluctuate due to alteration of water pressure at the installation location of the flush valve.

2. Description of the Prior Art

There are generally two ways to flushing toilets with water, one uses water tank and another one is direct flush. The water tank can store water and generate water pressure to control water flow to flush the toilet. Its structure is less likely to be affected by fluctuations of water pressure in the water inlet tube, and water outflow and time are more steady with less fluctuations. However, it requires a larger space for installation. The direct flush directly supplies flushing water through one end of a water pipe. It has a flush valve bridging between the distal end of the water pipe and the toilet.

The structure usually includes a corner valve directly connecting to one end of a water inlet tube to keep water constantly presented in normal conditions. A connection tube is connected to a water outflow valve to control water outflow. The water outlet end of the water outflow valve is directly connected to the water inlet of the toilet. A depressing rod or control button is provided to actuate the opening of the water outflow valve and set flushing time so that water is discharged directly from the distal end of the water pipe to flush the toilet. Such a flush structure can save the space of toilet. It also does not need the water control mechanisms in the water tank and the precise matching of plug and float ball that often cause water leaking or overflow when wear off or misalignment occurs. However, in practice, the diameter of the valve cannot be changed to adjust water outflow. Water outflow quantity and time fluctuate due to variations of water pressure in the connecting water pipe. When water pressure is higher on the installed location, water outflow quantity increases in the same time period being set. As a result, water resource is waste and water bill is higher. In addition, due to higher water pressure and faster water discharge speed, water flushing into the toiler tends to hit the side wall of the toilet and splash outside the toilet with sewage, and the environment is contaminated and polluted. On the other hand, when water pressure is lower, water discharge force is not adequate, and flushing effect suffers.

## SUMMARY OF THE INVENTION

The primary object of the invention is to provide a flush valve that allows variation of water pressure to affect water outflow quantity thereby to prevent waste of water resource and environmental pollution caused by water splash due to too high of water pressure or non effective flushing due to too low of water pressure.

The flow control apparatus of the flush valve according to the invention can alter the diameter of the valve according to pressure variation of intake water so that water outflow can be controlled, and instantaneous water outflow into the toilet can be maintained constant. The structure includes:

A flow control valve which has a diameter alterable according to water pressure so that water flowing through the valve is constant; and

A filter which may be coupled with the flow control valve in an integrated fashion or be an independent item. It is located at the front section of the water outflow valve for filtering intake water.

In one embodiment of the invention, the flow control valve and the filter are located between the water inlet end of the flush valve and the water inlet end of the water outflow valve. The diameter of the flow control valve is alterable flexibly according to pressure variation of intake water. When water pressure is higher, the flow control valve is compressed and deformed under the impact of the high water pressure, and the diameter becomes smaller, consequently instantaneous water quantity flowing through the

valve decreases, and total water outflow quantity can be maintained constant. On the other hand, when water pressure is lower, the diameter of the flow control valve maintains as that in normal conditions, and instantaneous water outflow quantity through the valve is greater than that when the water pressure is higher, and total water outflow quantity can still be maintained constant. By means of the flow control valve, water outflow quantity can be maintained constant to flush the toilet without affected by water pressure variation at different installation locations.

The foregoing, as well as additional objects, features and advantages of the invention will be more readily apparent from the following detailed description, which proceeds with reference to the accompanying drawings.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a sectional view of an integrated assembly installed in a flush valve according to the invention.

FIG. 2 is a sectional view of the structure of the invention.

FIG. 3 is a sectional view of another embodiment of the invention.

FIG. 4 is a sectional view of an embodiment of the integrated assembly installed in a flush valve.

FIG. 5 is a sectional view of another embodiment of the integrated

assembly installed in a flush valve.

FIG. 6 is a sectional view of yet another embodiment of the integrated assembly installed in a flush valve.

FIG. 7 a sectional view of still another embodiment of the integrated assembly installed in a flush valve.

FIG. 8 is a schematic sectional view of the flow control apparatus in operating condition.

FIG. 9 is a sectional view of an embodiment of a separated assembly installed in a flush valve.

FIG. 10 is a sectional view of another embodiment of a separated assembly installed in a flush valve.

FIG. 11 is a sectional view of yet another embodiment of a separated assembly installed in a flush valve.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

Refer to FIGS. 1 through 7 for the structure of the invention according to a first type of embodiments. It mainly includes a flow control valve 1 with an alterable valve diameter responding to variations of water pressure to control water flowing through the valve, and a filter 2 to filter intake water. The filter 2 is integrated with the flow control valve 1.

Referring to FIGS. 1 and 2, the flow control valve 1 is made from a flexible plastics or rubber by extrusion or injection. It has a valve opening 12 which is changeable under external forces. The flow control valve 1 has an annular valve casing 11 with the valve opening 12 formed in the center to allow water to pass through.

The valve casing 11 of the flow control valve 1 has one side receiving water pressure. That side may be attached to a rigid pressure receiving element 13. It may be integrated with the valve casing 11 by extrusion or plastic injection technique. As shown in FIG. 3, such a structure enables the flow control valve 1 to receive water pressure more evenly.

The filter 2 has a cage type barrel 21. As the embodiment shown in FIGS. 1 and 2, the filter 2 is a mesh structure containing a plurality of filter pores that allow water to flow through smoothly and filter out impurities so that the needle water outflow valve 31 in the flush valve 3 may be avoided from being clogged by the impurities and not operable.

In the first type of environments set forth above, the flow control valve 1 and the filter 2 may have different combinations and configurations. FIG. 1 illustrates one embodiment in which the flow control valve 1 is located in a chamber 23 of the filter 2 to become an integrated member, then is housed in a connection tube 32 of the flush valve 3. Of course the installation direction in the connection tube 32 has many options. FIG. 1 shows that the filter 2 is located at the front section of the flow control valve 1. FIG. 4 shows a

configuration contrary to the FIG. 1. FIG. 5 shows the flow control apparatus is installed in a valve chamber 33 on one side of the flush valve 3, and the flow control valve 1 is located at the front end of the filter 2. FIGS. 6 and 7 illustrate another type of structure. The flow control valve 1 and the filter 2 are integrated and located in the juncture of a water inlet tube 4 and a corner valve 34. Of course the installation direction has other options to allow the pressure receiving element 13 to face the water intake direction.

When the flush valve 3 equipped with the flow control apparatus is installed on a location where water intake pressure is higher, the high pressure water flows through the water inlet tube 4 and enters the flow control valve 1 to generate a compression pressure on the pressure receiving element 13, the flexible valve casing 11 abutting the pressure receiving element 13 is compressed axially and deformed. As a result, the valve opening 12 is shrunk. Therefore instantaneous water flow passing through the valve opening 12 decreases.

When water intake pressure is lower at the installation location, the low pressure water flows through the water inlet tube 4 and enters the flow control valve 1 without compressing the pressure receiving element 13 as shown in FIG. 2. Thus water can flow through the normal valve opening 12 to achieve a greater instantaneous water flow than the high water pressure condition previous discussed. Hence, by installing the flow control valve 1 at the front section of the water outflow valve 31, instantaneous water flow

passing through the water outflow valve 31 can be maintained constant, and instantaneous water released from the water outflow valve 31 can flush the toilet in a constant quantity at a constant time.

The structure of the invention set forth above may have many variations within the disclosed design concept. FIGS. 9 through 12 illustrate the structures and assemblies of a second type of embodiments. Like the first type of embodiments previously discussed, there is a flow control valve 1 with alterable valve diameter to respond variations of water pressure and control water flowing through the valve, and a filter 2 to filter intake water. The characteristics are as follows:

The flow control valve 1 and the filter 2 are separated and installed independently in the flush valve 3. Many different installation locations may be adopted. FIG. 9 shows that the flow control valve 1 is located in the connection tube 32 while the filter 2 is located in the chamber 33 of the flush valve 3. FIG. 10 shows another arrangement in which the flow control valve 1 is located at the front side of a distal end of the water inlet tube 4 and the corner valve 34 while the filter 2 is located in the connection tube 32. FIG. 11 shows yet another arrangement in which the flow control valve 1 is located in the water outflow valve 31 and connects to the water inlet end of the water discharge tube 5 of the toilet, while the filter 2 is located in the chamber 33 on one side of the flush valve 3. All the types and embodiments set forth above can provide same water flow control effect to enable water

released from the water outflow valve 31 to pass through the flow control valve 1 and maintain a constant instantaneous water quantity to flush into the toilet.

While the preferred embodiments of the invention have been set forth for the purpose of disclosure, modifications of the disclosed embodiments of the invention as well as other embodiment thereof may occur to those skilled in the art. Accordingly, the appended claims are intended to cover all embodiments which do not depart from the spirit and scope of the invention.